Written evidence submitted by the Centre for Ecology and Hydrology (AZE0009)

INTRODUCTION

[1] Professor Chris Evans, Dr Amanda Thomson and Dr Ross Morrison are providing evidence to this inquiry on behalf of the Centre for Ecology & Hydrology (CEH). The evidence submitted here adds to our earlier submission to the EFRA peatland inquiry in the specific area of UK peatlands under agricultural management.

[2] CEH is a centre of excellence for integrated research into land and freshwater ecosystems and their interaction with the atmosphere. CEH is a Natural Environment Research Council (NERC) research institute, part of UK Research and Innovation (UKRI).

[3] CEH has a leading role in large-scale, long-term monitoring and research on UK agriculturally managed peatlands, working in collaboration with other research institutes, higher education organisations, government agencies, private sector and non-governmental organisations. CEH is responsible for the Land-Use, Land-Use Change and Forestry (LULUCF) component of the UK's national greenhouse gas (GHG) emissions inventory, and led the development of methods to include agriculturally managed peatlands in the inventory. CEH also operates the majority of the UK's current GHG monitoring stations ('flux towers') on peatland, and has led or is leading several major government-funded peatland research projects, including the £2.5m Defra Lowland Peat programme.

[4] Professor Chris Evans is a biogeochemist and was the lead for the Defra Lowland Peat and BEIS peatland inventory projects, and lead author for the IPCC Wetland Supplement. Dr Amanda Thomson is an ecosystems modeller and is the lead scientist for the LULUCF inventory and Committee on Climate Change assessment of climate mitigation potential from land-use. Dr Ross Morrison is a flux scientist and is the lead for the CEH flux tower network.

EXECUTIVE SUMMARY

[5] The utilisation and degradation of England's peatlands has turned them from a small net sink for CO_2 into a significant source of GHG emissions (provisionally estimated at around 23 Mt $CO_2e\ yr^{-1}$). Around 55% of the UK's peatland GHG emissions, and over 80% of English peatland GHG emissions, are associated with lowland peat under arable, horticultural or grassland agriculture. This emission contributes significantly to total UK GHG emissions from the agricultural sector.

[6] To date, very little mitigation of GHG emissions from lowland peat under agriculture has been achieved, in part due to the high agricultural productivity and economic value associated with these soils. If the UK is to achieve its target of net zero greenhouse gas emissions, it will be necessary to take further steps to reduce GHG from agricultural peatlands.

[7] There is strong evidence that raising water levels in agriculturally drained lowland peatlands could make a significant contribution to UK climate change mitigation, but this needs to be reconciled with the need to maintain food production and support rural economies. Ongoing work for Defra is examining the trade-offs and opportunities involved in raising water levels within peatlands remaining under agricultural management.

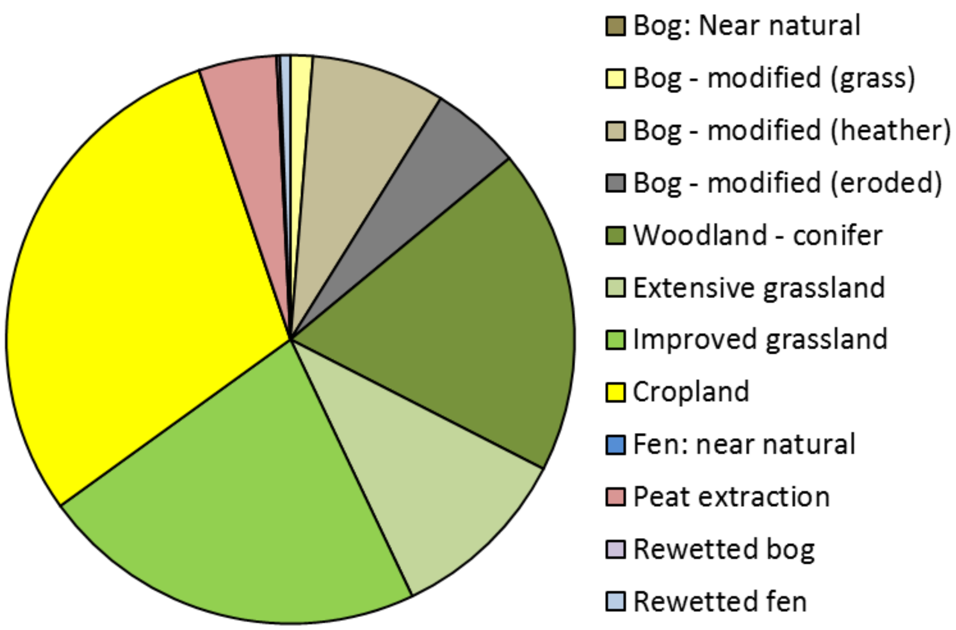
EVIDENCE

[8] Globally, peatlands emit around 1.2 to 1.9 Gt of CO_{2e} to the atmosphere each year[1,2]. This represents 2-4% of all anthropogenic GHG emissions, and 20-30% of emissions from the Agriculture, Forestry and Other Land Use sector[3].

Q1. How could 20% of UK agricultural land be repurposed to increase forest cover, restore peatlands, implement catchment-sensitive farming and enable agricultural diversification, whilst maintaining current levels of food production?

[9] Based on the 2013 IPCC Wetland Supplement[4], the CEH-led BEIS Peatland Inventory project[5] estimated that the UK's peatlands as a whole are emitting 23 Mt $CO_2e\ yr^{-1}$. This equates to 5% of reported total GHG emissions for the UK for 2017. Over half of these emissions are attributable to agricultural activities, primarily on lowland peat (Figure 1)

***Figure 1**. Proportional contribution of different land-use activities to total estimated greenhouse gas emissions from UK peatlands.*

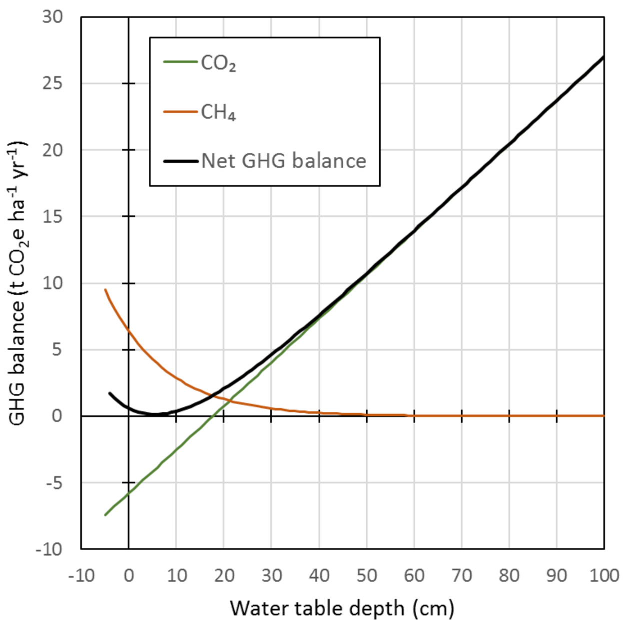


[10] Around 3.5% of the UK's cropland area is on peat, and around 2.6% of its improved grassland area[5,6]. This relatively small area is estimated to generate GHG emissions equivalent to around one third of currently reported net emissions from the Agriculture, Forestry and Other Land-Use (AFOLU) Sector[7]. Reducing or halting emissions from agricultural peatlands would therefore make a significant contribution to achieving net zero emissions from agriculture.

Q4) How could innovative technologies and farming practices help the agriculture sector achieve net zero? Are they currently commercially viable or is there a viable path to market for them?

[11] There is strong evidence that the depth of the water table in peatlands is of overriding importance in determining its carbon and GHG balance. A collation of UK and international measurements made using the state-of-the-art 'flux tower' method (Figure 2[8,9]) indicates that for every 10 cm that water tables are raised towards the surface, CO_2 emissions will be reduced by around 3 t CO_2 ha^{-1} yr^{-1}. This reduction in GHG emissions will only be offset by higher methane emissions if water levels are raised above the peat surface.

Figure 2. *Observed relationships between carbon dioxide (CO_2), methane (CH_4) and their combined climate impact (net GHG balance) based on 38 UK and international CO_2 flux tower studies, and 37 UK and Irish studies of CH_4 fluxes[12]. The net GHG balance is based on the IPCC's 100-year global warming potential (GWP) for CH_4 of 28, i.e. assuming that CH_4 is 28 times more powerful as a greenhouse gas than CO_2. Note that the optimal GHG balance of a peatland occurs when water tables are within 0-10 cm of the ground surface.*



[12] We estimate that halving average drainage depths across the 433,000 ha of peat under intensive agricultural use in the UK could reduce their emissions by around 70%. This would not necessarily preclude the continued agricultural utilisation of these areas, which in many areas (notably the East Anglian Fens) comprise high-grade agricultural land, and make a major contribution to UK food production and the rural economy, although changes in crop type and management practices would be required. CEH are leading a current project for Defra to examine the trade-offs and opportunities involved in raising water levels within arable/horticultural peatlands.

[13] In order to completely halt CO_2 emissions from agriculturally utilised peatlands, it would be necessary to either fully restore them to wetland ecosystems (which would have significant associated social and economic costs in some areas) or to develop new forms of wetland agriculture ('paludiculture') that combine the protection of carbon of peatland areas with their continued productive use. Work is ongoing in a number of projects to evaluate the GHG

abatement and economic potential of paludiculture crops, including field trials, but further development and new economic models are needed before this approach could be scaled up.

Q6) What impact would encouraging a shift in diets towards lower red meat and dairy consumption have on agriculture, and how could any negative impacts be mitigated?

[14] On upland peatlands, there are few if any agricultural alternatives to livestock production. In lowland peatlands, croplands generally require deeper drainage than grasslands, therefore reduced use of these areas currently managed for meat and dairy production could lead to higher CO_2 emissions from the peat compared with current agricultural practices. However, full accounting is required to assess whether enhanced CO2 emissions from deeper peatland drainage would outweigh reductions to non-CO2 GHG (methane and nitrous oxide) emissions from reduced livestock density. This would not be the case if higher water table management techniques could be developed for crops, however.

Q7) How can any reduction in UK-agricultural GHG emissions be achieved without 'offshoring' emissions to other countries via increases in the consumption of imported foods in the UK?

[15] There is a risk that decreases in agriculture-related emissions from UK peat soils could be cancelled out or even exceeded by emissions resulting from air-freighting of produce (notably fresh vegetables) from overseas. To achieve a genuine GHG emissions reduction, any decrease in UK vegetable production on peat soils would need to be offset by increased UK production on mineral soils.

RECOMMENDATIONS

1) Agriculturally utilised peatlands are a significant contributor to the UK's total GHG emissions (~2%) and are an emissions hotspot within the agricultural sector, therefore strategies to achieve 'net zero' GHG emissions from UK agriculture should include consideration of peatlands.
2) In lowland peatlands under agricultural management, large-scale restoration to wetland is unlikely to be economically viable or societally acceptable in the short-term, and would significantly impact on UK food production. In these areas, we recommend that continued policy attention be given to the development of effective management options that would reconcile their ongoing agricultural use with the need to reduce their contribution to GHG emissions and extend their agricultural lifetime.

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